13 + Entrance Examination

Paper 1

Physics - Level 2

Total marks: 60

Time allowed: 40 minutes

Calculators may be used

Full name .....

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1. **Circle the correct answer for each of the following questions:**

   a. On Earth the gravitational field strength is 10N/kg. What would be the weight of someone on Earth who had a mass of 75kg?

   750N/kg 750N

   75N 7500kg

   b. What is the force that acts against the weight of an object in water?

   friction upthrust

   weight air resistance

   c. The tilt of the Earth on its axis as it orbits the sun is the reason we get ...

   day and night leap years

   seasons years

   d. A crane is lifting a load of 10,000N at a distance of 4 metres from the pivot. What is the strength of this turning effect?

   40,000Nm 2,500Nm

   25Ncm 400,000Nm

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e. Which is not a renewable source of energy?

biomass	natural gas
hydroelectric	geothermal

f. What is energy measured in?

watts	amps
volts	joules

g. Which of the following will not increase the strength of an electromagnet?

insert an iron core	add more coils of wire
increase the current	decrease the voltage

h. Which medium will sound travel best through?

a vacuum	a solid
a liquid	a gas

i. Which planet in our solar system is closest to the Sun?

Earth	Venus

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Mars Mercury

j. On an oscilloscope trace, how would you recognise a high-pitched sound?

the height of the waves will be small | the height of the waves will be tall

there will be many waves in the given time | there will be few waves in the given time

(10 marks)

2. A polar bear's foot has area of 800cm^2 and the polar bear has a weight of 8000N.



a. State the relationship between pressure, area and force.

_____

_____

_____

(1 mark)

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b. Calculate the pressure the bear exerts on the ice if all four paws are in contact with the ice. Include the unit of measure.

_____

_____

_____

(2 marks)

c. When walking on thin ice, there is a danger of breaking through the ice and, to reduce this risk, the polar bear will spread their legs in order to distribute their weight. Explain, in terms of pressure, why this may help.

_____

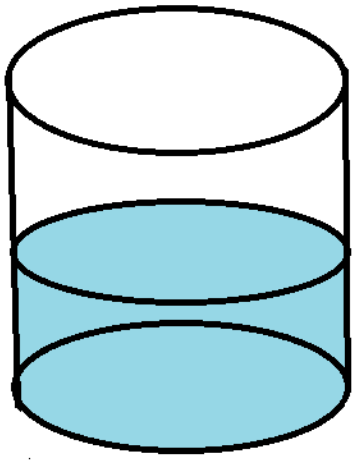
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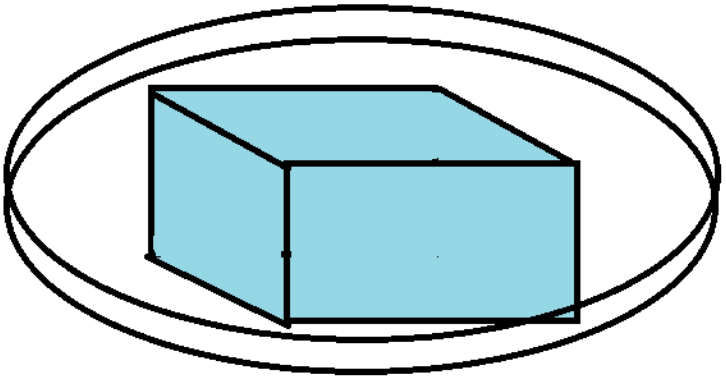
(2 marks)

3. **An ice cube in a glass of water will float yet the ice is made up of exactly the same matter as the water. To investigate this further, 10 grams of pure water was measured and left in its liquid form. Another 10 grams of pure water was measured and subsequently frozen. The volume of each was then measured to see if there was any difference.**

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10 grams of H_2O in liquid form



10 grams of H_2O in solid (ice) form

a. What would be used to measure the volume of the liquid water accurately?

_____ **(1 mark)**

b. How could the volume of the ice cube be measured accurately?

_____

_____

_____

(1 mark)

c. The volume of the pure water in ice form was approximately 11ml. Work out the density of the ice. Include the unit of measure.

_____

_____

_____

_____

_____

_____

_____

(3 marks)

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d.

i. In order for the ice to float would the volume of the water in liquid form need to be less than, greater than or the same as the volume of the ice block?

_____ **(1 mark)**

ii. Explain, in terms of density, your answer:

_____

_____

_____

(2 marks)

e. How was this test fair?

_____

_____

_____

(1 mark)

4. Draw a circuit diagram to show an LED and a lamp in a series circuit with two cells.

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(3 marks)

b. Explain why if the light bulb broke, the LED would go out as well.

_____

_____

_____

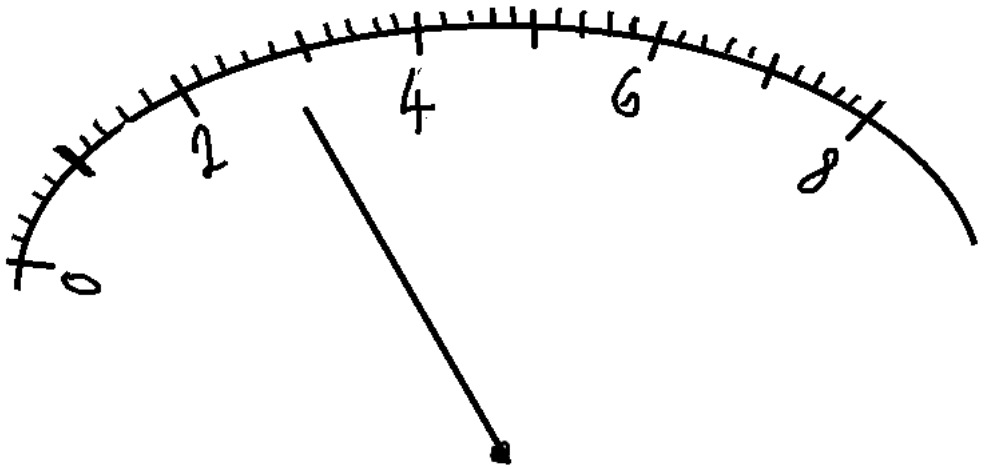
(2 marks)

c. In order to be able to vary the brightness of the circuit simply, what component should be added?

_____ **(1 mark)**

An ammeter is placed into the circuit and shows this reading:

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d. What is the reading?

_____ amps **(1 mark)**

e. The bulb is now removed from the circuit and a complete circuit is made with the remaining components. The reading on the ammeter is then checked again. How will this have been affected? Explain your answer.

_____

_____

_____

(2 marks)

5. At the top of a steep hill, a cyclist begins her descent. She keeps picking up speed until a point is reached on the descent where she, despite going very fast, is no longer accelerating.

a. What is the name of the force that is causing her to initially accelerate?

_____ **(1 mark)**

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b. What is the name of the force acting against her downwards motion?

_____ **(1 mark)**

c. If she eventually travels at a constant speed, what must be happening to these two forces acting on her?

_____

_____

_____

(1 mark)

d. The cyclist is not an expert and wants to know how she could reach even greater speeds. What two pieces of advice would you give?

_____

_____

_____

(2 marks)

e. The distance from the top of the hill to her house is 3.8km. The journey took 3 minutes and 20 seconds. What was her average speed in m/s?

_____

_____

_____

(2 marks)

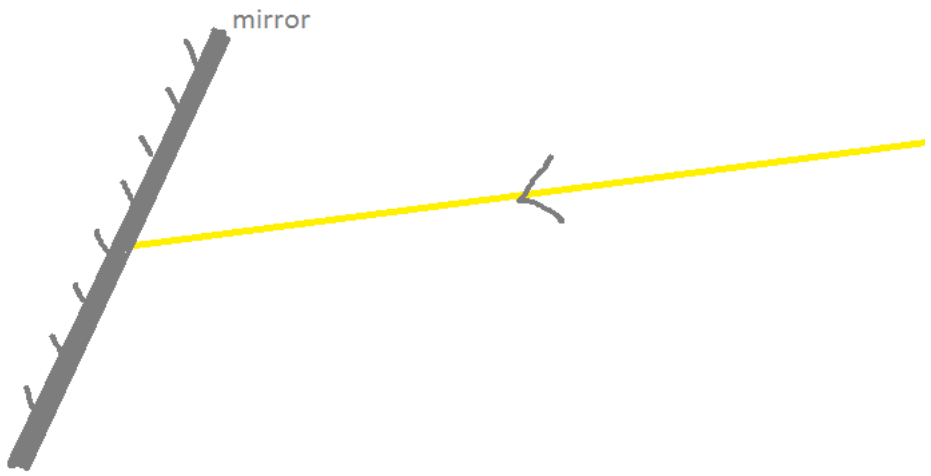
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f. Energy is the amount of work that has been done or can be done. Match the following types of energy with the correct answer relating to the cyclist's journey:

Gravitational potential energy	This is what enables the cyclist to push down on the pedals
Chemical energy	The faster she goes the more of this type of energy she gains
Kinetic energy	When the bicycle brakes are pressed the spinning wheels slow and this creates this type of energy
Thermal energy	At the top of the hill, where it seems nothing much is happening 'work wise', she has lots of this energy

(4 marks)

6. Using a mirror, a beam of light can be directed to hit a specific point.

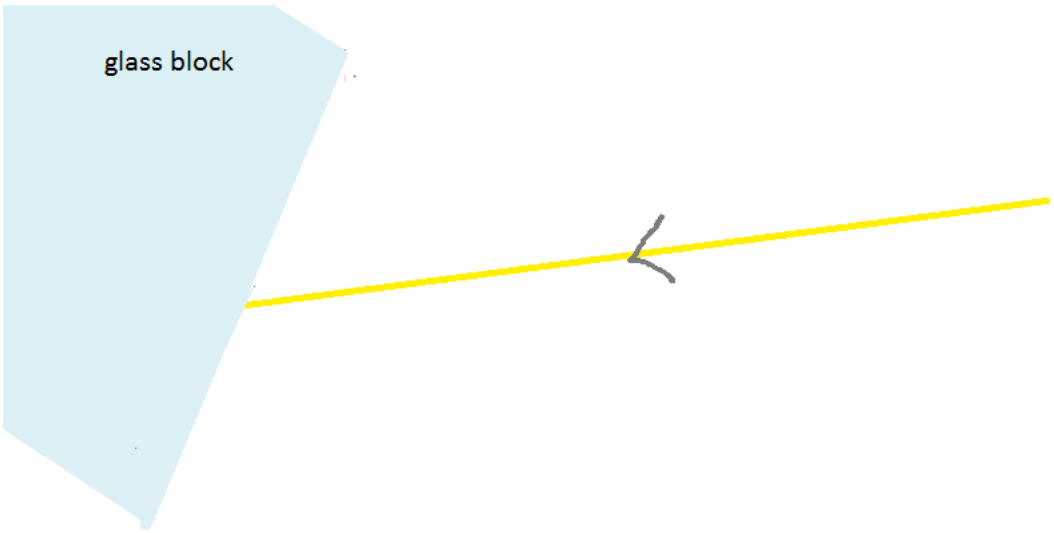


a. On the diagram:
   i. mark on the normal
   ii. draw the reflected ray – use a protractor
   iii. label the angle of incidence

(3 marks)

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The mirror is now replaced with a glass block



b. On the new diagram draw where the light path will continue.

(2 marks)

c. What do we say happens to the light when it enters a different medium?

_____ **(1 mark)**

d. When white light passes through a prism, it can separate into the spectrum. What is this called?

_____ **(1 mark)**

e. What is the colour order of the spectrum?

_____

_____

_____

(2 marks)

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7.





The Sun **Earth**

a. On the diagram above, draw on the position of the moon:

i. to show a solar eclipse. Label this S.

ii. to show a lunar eclipse. Label this L.

(2 marks)

b. What is the name given to a body, like the moon, that orbits a planet?

_____ **(1 mark)**

c. How long does each of the following take?

The moon to orbit the Earth: _____

The Earth to orbit the sun: _____

The Earth to make a complete rotation on its axis: _____

A geostationary satellite to orbit the Earth: _____

END OF TEST

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Mark Scheme 13+ Physics Paper 1

1. **(10 marks)**
   a. 750N
   b. upthrust
   c. seasons
   d. 40,000Nm
   e. natural gas
   f. joules
   g. decrease the voltage
   h. a solid
   i. Mercury
   j. there will be many waves in a given time

2.
   a. pressure = force / area (or any correct combination) **(1 mark)**
   b. 8000 / 800*4 = 2.5 N/㎠ **(2 marks - correct number and unit of measure)**
   c. If a large force is concentrated on a small area, that will result in high pressure. If the pressure on the thin ice is too great, it may break. Therefore the force of the polar bear is spread out over as large an area as possible to spread out the force and therefore reduce the pressure. **(2 marks)**

3.
   a. measuring cylinder **(1 mark)**
   b. measure the length, width and depth using a ruler and multiply these three dimensions together **(1 mark)**
   c. 11ml = 11㎤ and density = mass / volume
      10 / 11 = 0.91g/㎤ **(3 marks - 2 for correct number, 1 for unit of measure)**
   d. i. less **(1 mark)**
      ii. anything that is less dense than its surroundings will rise / float. The atoms in ice take up a greater volume than the matter in the surrounding water and as such has a smaller density **(2 marks)**
   e. pure water was used in both samples and the same starting mass of water was used in both samples **(2 marks)**

4.
   a. symbols correctly drawn **(1 mark)**
      LED correctly aligned in direction of current flow **(1 mark)**
      All components within a series circuit **(1 mark)**
   b. If the light bulb breaks that means there will now be a break in the circuit meaning current can't flow. Therefore nothing, including the LED, will work **(2 marks)**

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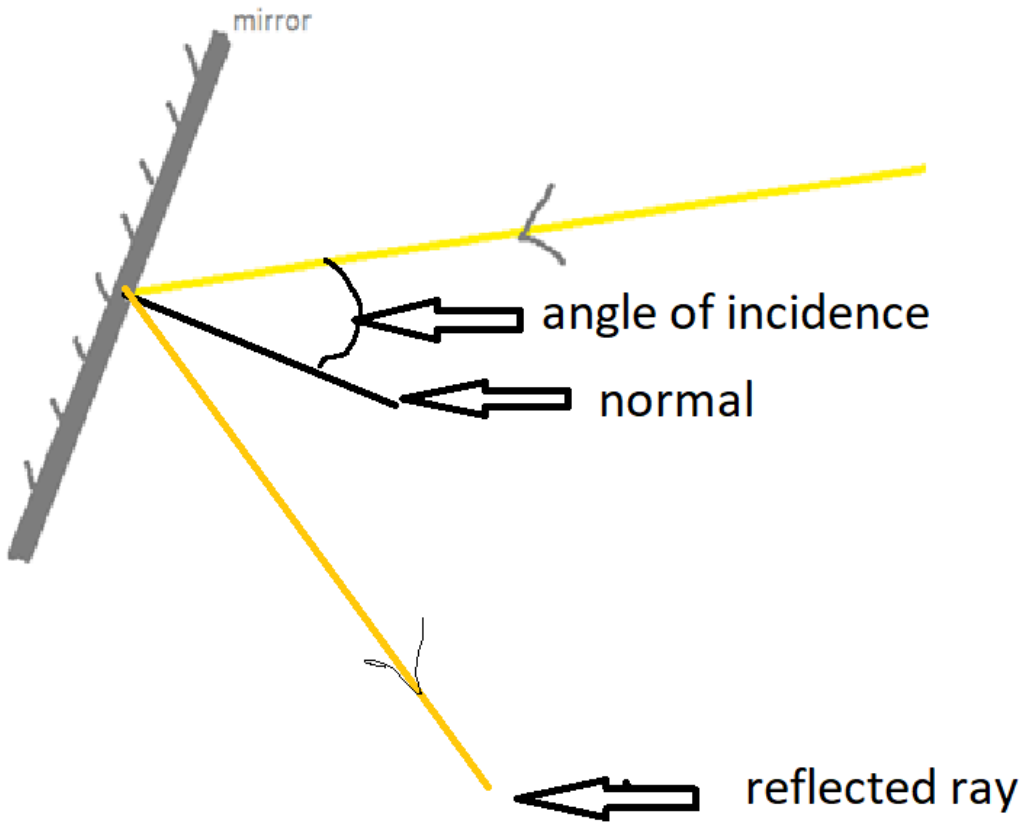
c. Variable resistor **(1 mark)**
d. 2.8 amps **(1 mark)**

5.

a. weight / gravity **(1 mark)**
b. air resistance / friction **(1 mark)**
c. they must be balanced **(1 mark)**
d. wear tight clothing and position body to be more aerodynamic / keep everything tightly tucked in (less of you hitting air on the descent which will slow you down) **(2 marks)**
e. 3800m / 200s = 19m/s **(2 marks)**
f. Gravitational potential energy→At the top of the hill, where it seems nothing much is happening 'work wise', she has lots of this energy
Chemical energy→This is what enables the cyclist to push down on the pedals
Kinetic energy→The faster she goes the more of this type of energy she gains
Thermal energy→When the bicycle brakes are pressed the spinning wheels slow and this creates this type of energy **(4 marks)**

6.

a. **also b(3 marks)**



c. it refracts **(1 mark)**
d. dispersion **(1 mark)**

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e. Red orange yellow green blue indigo violet **(2 marks)**

7.

a. i) Moon to be placed in-between the Sun and the Earth **(1 mark)**
ii) Moon to be placed on the right hand side of the Earth **(1 mark)**
b) Satellite **(1 mark)**
c) 28 days
365.25 days (allow 365 days)
24 hours
24 hours **(4 marks, 1 for each answer)**

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